REMARKS

In this Amendment, Applicant has cancelled Claims 2 – 3 without prejudice or disclaimer; and amended Claims 1, 4, 5, 7 and 16 to overcome the rejections and further specify the embodiments of the present invention. In addition, the drawing has been amended to correct informalities. It is respectfully submitted that no new matter has been introduced by the amended drawing and claims. All claims are now present for examination and favorable reconsideration is respectfully requested in view of the preceding amendments and the following comments.

DRAWING OBJECTION:

Figs. 1 and 2 have been objected to as not being properly labeled.

It is respectfully submitted that the amended Figs. 1 – 2 include proper labels for various parts. Therefore, the objection to Figs. 1 – 2 has been overcome and withdrawal of objection is respectfully requested.

REJECTIONS UNDER 35 U.S.C. § 102:

Claims 1 – 2 and 16 – 17 have been rejected under 35 U.S.C. § 102 (b) as allegedly being anticipated by Colbaugh (US 5,330,136), hereinafter '136 Patent.

Applicant traverses the rejection and respectfully submits that the presently claimed invention is not anticipated by the cited reference. It is respectfully submitted that the present invention as claimed in amended Claim 1 is clearly distinguished from '136 Patent by virtue of including the features from previous Claim 3.

The present invention is directed towards a railway monitoring system which has a single optic fiber extending along or adjacent at least one rail of a railway track. Sensor portions are incorporated in series along the optic fiber in the form of "Bragg gratings" at

portions along the fiber where monitoring is required, for example hundreds of meters or kilometers apart. The Bragg gratings may be integrally formed within the fiber or optically joined so as to provide a continuous single optical pathway. Each of the Bragg gratings is with its own reflected wavelength.

An optical signal emitter (or light source) is provided in communication with the optic fiber which sends the signal down the fiber and an optical signal analyzer is provided to receive, detect and analyze the reflected wavelengths of all the gratings (which are the sensors).

A shift in the wavelength (due to track strain from a load of a rail car) can be detected amongst other reflected signals. As each "sensor" has its own reflected frequency, a shift of that wavelength is associated with a particular sensor.

The invention described in '136 Patent is a railway track apparatus for detection of the presence of a railway vehicle in a track section of a railway line. The invention of '136 Patent provides an optical sensor (13) that emits a vehicle detection signal upon the presence of a railway car. The detection signal may be a reflection or change of intensity (or other property) of a reference signal or may be the generation of a signal. The sensor may be an elongate optic fiber or a plurality of localized sensors. The system of '136 Patent includes a track circuit **each having code track equipment set (CTS) corresponding to each respective section of track (Figure 2)**. The present invention as defined is significantly different.

Therefore, the newly presented claims are not anticipated by '136 Patent and the rejection under 35 U.S.C. § 102 (b) has been overcome. Accordingly, withdrawal of the rejection under 35 U.S.C. § 102 (b) is respectfully requested.

REJECTIONS UNDER 35 U.S.C. §103:

Claims 3 – 10 have been rejected under 35 U.S.C. §103 as allegedly being unpatentable over '136 Patent, in view of Varasi (US 5,493,390, hereinafter '390 Patent). Claims 11 – 12 have been rejected under 35 U.S.C. §103 as allegedly being unpatentable

over '136 Patent, in view of '390 Patent further in view of Vengsakar (US 5,641,956, hereinafter '956 Patent).

Applicant traverses the rejection and respectfully submits that the embodiments of present-claimed invention are not obvious over the cited prior art references. First, it is respectfully submitted that Examiner made a clerical error in referring to "Varasi" as "Patent No. 5641956." The correct citation is "U.S. Patent No. 5,493,390 to Varasi." The present response is based on this corrected citation. Correction by the Examiner is respectfully requested.

As stated above, there are significant differences between the present invention and the '136 Patent. In addition, the '390 Patent is directed to an invention **for diagnostic and measurement of strain and temperature of structures or within structures**, for structures requiring continuous or periodic monitoring of the parameters of strain and temperature (see Field of the Invention).

In the "*Background of the Invention*" section, the '390 Patent teaches that the invention is in the field for providing either surface monitoring of safety-critical components and structures or optimizing the usage, especially if the structures or components are fabricated of composite materials. The '390 Patent discloses the need as being particularly critical in the field of structures and components utilized for aerospace, naval and railway applications and in the construction field. Examples of such structures to be monitored include bridges, viaducts, oil ducts, offshore platforms, etc. (col. 1, lines 17-25).

In fields of application such as those disclosed in the background of the present invention, the '390 Patent indicates that "optical sensors, either attached to the component surface (the structure) to be monitored or embedded where possible, are particularly suitable for these applications" (emphasis added, col. 1, lines 28 – 30).

The prior art referred to in the "*Background of the Invention*" section of the '390 Patent includes carbon fiber impregnated within a polymeric matrix obtained via an autoclave process, as being particularly important to which the technical field pertains. Furthermore, throughout the "*Background of the Invention*" section of the '390 Patent, it describes the embedding of a sensor within the layers of a composite, and the use thereof. Moreover, throughout the "*Background of the Invention*" of the '390 Patent, it discussed prior art in complex technical details with respect to structural **monitoring**.

Turning to the disclosed invention of the '390 Patent, its "*Summary of the Invention*" section disclosed an optical system which includes an optical fiber, a light source, at least one fiber sensor for providing reflected wavelength, integrated tunable opto-acoustic filter, optical detection means and signal processing means. Furthermore, in the "*Summary of the Invention*" section of the '390 Patent, it admits that the possibility of measuring the mechanical and thermal state of composite structures and components with embedded optical fiber sensors has already been demonstrated. However, the patentee of the '390 Patent indicates that such laboratory instrumentation is cumbersome. Furthermore, the patentee distinguishes the invention of the '390 Patent by providing a complete compact and integrated system suitable for real-time monitoring of surface strains on structures and components.

Further, in the "Summary of the Invention" section of the '390 Patent, the patentee makes reference to *"in particular cases of aeronautical applications, the invention described here is suitable for the development of smart structures technology, for its characteristics of reduced instrumentation volume and weight, for its portability, for its utilization versatility in terms of measuring static and dynamic strains, jointly or separately, without the need for reconfiguration of the system architecture*".

Still further, as disclosed in the "Summary of the Invention" of the '390 Patent, the patentee indicates that *"This invention is appropriate for application in the fields associated with smart structures development. As an example, the invention is applicable to the in-service monitoring of structures and components in the aerospace, railway, water and construction fields*".

In addition, in the "Summary of the Invention" the patentee of the '390 Patent states that *"In addition, the invention can be used to monitor the changes in internal strain state and temperature of a composite structure as it is consolidated during any number of composite fabrication techniques. Examples of such applicable consolidation methods are autoclave curing, closed-mold curing, resin transfer molding or resin injection molding"*.

Throughout the detailed description of the invention, **there is no reference to any other applications of the invention of '390 Patent other than the structures as disclosed**. The description is of a highly technical nature in relation to the specific implementation of the system as described within the specification. The only application and implementation as described in the "specific description" is in column 15, line 1-15, wherein it is stated that *"In this form, the architecture of the system is suitable for integration into strain and temperature data acquisition systems required by any of the fields of the application described earlier"*. Thus, no expansion upon the specific applications as previously described exists. Furthermore, it is stated that "*Of particular interest is the use of the instrument module for the measurement of static and/or dynamic strain in epoxy matrix structures. This configuration is particularly suited to the acronautical field. For this application, fiber grating sensors 3 are embedded at points where real-time monitoring and measurement of static and dynamic strain is desired during the in-service operation of the structure 4*".

The '390 Patent is directed to the technical field of monitoring and diagnostics of structures, as described above. The technical field to which '390 Patent pertains is **for measurement and monitoring of structures**, in particular within the aerospace industry and civil engineering industries. Throughout the '390 Patent, it is constantly disclosed as the purpose of the invention **to monitor structures** and provide feedback, for example, in fields associated with smart structures development, such as in-service monitoring of structures and components in the aerospace, railway, water and construction fields.

By comparison, the present invention is directed to **the field of logistics monitoring of a railway system,** in particular in relation to the monitoring of railway vehicles. The present invention is **not** directed towards the monitoring of any structural

components for safety or maintenance considerations, but rather by contrast, **is directed to the monitoring of railway vehicles at particular points along a railway track system**.

Although the present invention utilizes a small amount of strain imparted towards the rail of a railway line (structure) upon a train or railway vehicle passing thereover, the sensor is utilized in a **railway monitoring system** for monitoring the presence of the train, not monitoring the structural integrity or serviceability or integrity of the railway line (structure).

The present invention utilizes strain in part to a structure (i.e. a railway line) so as to allow the monitoring of a system **associated with the structure**, that system being a railway system, not a railway track integrity monitoring system.

The present invention is **not** providing "*continuous or periodic monitoring of (static and/or dynamic strain and temperature of structures) of these parameters*". By contrast, the present invention "detects" the presence of a railway vehicle upon such a vehicle passing a predetermined point on the railway system (i.e. the railway structure) for analysis of train parameters. However, it is **not** used for a diagnostic or measurement of the structure whatsoever.

The '390 Patent being directed to the technical field of monitoring of structures such as bridges, viaducts, oil ducts, offshore platforms, which is a structural/civil engineering application, as opposed to the technical field of the present invention which is directed to logistic management of a railway system. The '390 Patent is solely directed towards the monitoring of an engineering structure and does not provide any hint or suggestion as to the monitoring of external systems associated with the structure, such as a railway system. In view of there being no suggestion, disclosure or hint as to any other applications other than those as described in '390 Patent, it is respectfully submitted that there would be no motivation for a person of ordinary skill in the relevant art to modify or combine the '390 Patent with other arts to conceive the present invention (i.e. logistic monitoring and rail network management).

Regarding the alleged motivation to combine cited references, it is respectfully submitted that the invention of the '136 Patent uses change in optical power of sensitized

regions of an optic fiber to sense strain or rain deformation, that being indicative of the presence or passing of a railway vehicle. At each location of a sensitized region, there is located an independent detector and light source, and associated hardware (Code Track Equipment, CTS) for detection of a change in optical power indicative of strain. A signal is then provided by each CTS of information pertaining to a change at that location.

It is submitted that even if a person of ordinary skill in the art was to look to the '390 Patent for a solution towards an application which is not remotely suggested in the '390 Patent, no motivation would exist to direct such a person to implement the structural monitoring system of the '390 Patent in combination with the railway monitoring system of the '136 Patent, in order to arrive at the presently claimed invention.

Even if a person skilled in the art was to look towards the disclosure of '390 Patent that Bragg gratings could be used to detect strain, implementation of a Bragg grating would still result in each CTS independently determining the strain at each sensitized location, and providing a signal associated with that location.

Although FBG sensors and many applications using these optical sensors as strain elements are widely reported in the last 10-15 years, but no work on using FBG sensors as strain (or vibration) sensors on rail tracks were ever reported in the public domain.

Furthermore, as "strain" has not been viewed as an acceptable measurement mechanism for railway monitoring in view of the associated complications of EMR and of the prevailing respective of RF transmitter/receiver assemblies, the use of strain sensing techniques in the technical field of railway monitoring cannot considered to be mere selection or common general knowledge by those skilled in the art.

It should be noted and appreciated that although FBG sensors are fragile and difficult to apply along the Main Line of railway systems, the inventors have taken great pains to address such issue to make sure they can survive for many years in a railway environment.

It is not obvious for a person of ordinary skill in the optical sensor art to extend the use of FBG sensors to railway application because FBG sensors are very fragile and it is not easy to envisage how FBG sensors can be fitted onto the rail track and function

(durably and reliably) in a satisfactory manner. If FBG sensors are used in railway environment, it is difficult to tell whether the sensors have fallen off from the track because the interrogator (i.e. the detector) could not tell whether the sensors are secured (i.e. attached) onto the rail. Hence, most optical experts opined that FBG sensors are not suitable, at least not ready, for railway applications.

Present implementations of the system according to the present invention, by using FBG sensors implemented reliably KCRC train line in Hong Kong, have surprisingly accomplished significant advantages over the prior art, namely:

i) simplicity – because many sensors can be installed and just one optical fiber, one optical source and one optical detector are needed and shared by many sensors;

ii) reliability – as wavelengths are being measured, there is no need to calibrate and re-calibrate the system periodically. Even if the sensors are replaced, there is no need to re-calibrate the system either;

iii) general convenience – The present invention provides many uses, for example, the FBG sensors can be installed on the two sides of the same rail to monitor the weight of each wheel. It is possible to detect whether the train has a derailment danger at many points along the Main Line, because if a train is about to de-rail. One side of the wheels will have a much lower weight compared to the other side of the wheels on the same axle.

However, for conventional systems, one cannot install strain gauges in the Main Line (because of EMI and because of the need to install many amplifiers and this is impracticable). Hence, it is necessary to have a dedicated plant to check the uniformity of the wheel weight before a freight train can be declared fitted for the railway network.

For example, there is a weighing system at Lo Wu for KCRC to check the weights of the left and right hand wheels before a freight train from the Mainland China is allowed to enter into the Hong Kong KCRC network. In addition, the signal picked up from the Main Line could be processed in real time to give a lot of valuable information, such as

train speed, train load, train location, derailment danger, vibration, etc, which are hitherto unavailable because of limitations of the conventional systems.

Furthermore, the inventors are confident that there are many important and unique features of the FBG sensor networks that could really revolutionize the railway industry and this explains why they have spent many years of their research effort to investigate the application of FBG sensors in the railway industry. In view of the above, it cannot be considered that a person of ordinary skill in the art would even look towards '390 Patent for implementation within the railway monitoring technical field. It cannot be considered to be common general knowledge or an alternate implantation, in particular in view of the prevailing practice in the art.

In view of the above, it is submitted that the present invention as claimed is clearly distinguished from both '136 Patent and '390 Patent either alone or in combination, and is non-obvious in view of the cited art.

Therefore, the rejection under 35 U.S.C. §103 has been overcome. Accordingly, withdrawal of the rejections under 35 U.S.C. §103 is respectfully requested.

Having overcome all outstanding grounds of rejection, the application is now in condition for allowance, and prompt action toward that end is respectfully solicited.

Respectfully submitted,

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